REMARKS

Claims 2, 3, 14, 20 and 37-44 remain pending for further prosecution in the present application and claims 21-25 are withdrawn as being directed to a non-elected species but remain in the application in the event that they can be re-joined. Arguments are submitted with respect to the patentability of the claims. Accordingly, Applicants respectfully submit that the present application is in condition for allowance and rejoinder is respectfully requested.

Claim Rejections - 35 USC §103(a)

A. In the non-final Office Action dated January 20, 2011, claims 2, 3, 14, 20, 37, 38 and 42-44 are rejected under 35 USC §103(a) as being obvious over the publication of Fan et al. titled "Deformation behavior of Zr-based bulk nanocrystalline amorphous alloys" in view of U.S. Patent No. 4,992,095 issued to Nate et al.

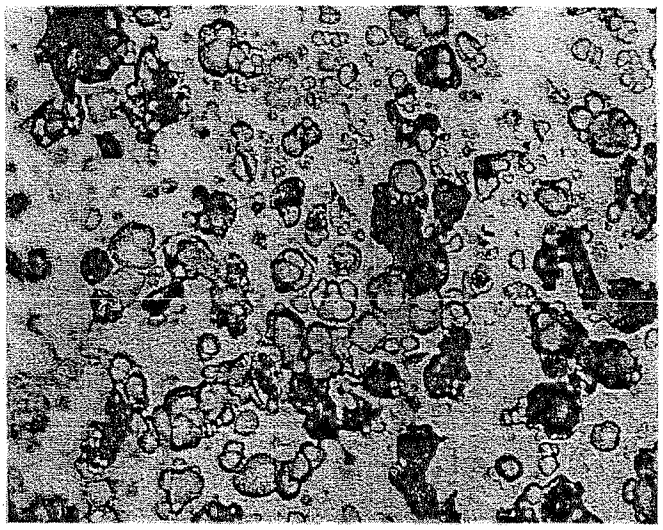
In the non-final Office Action dated January 20, 2011, it is readily admitted that Fan et al. does not teach a sintered body sputtering target made of sintered gas atomized powder of bulk amorphous metallic glass (as require by independent claims 2 and 37 of the present application). Nonetheless, the claims are rejected on the following basis:

> "Nate et al. ('095) discloses amorphous materials can be formed into sputtering targets by sintering powders of desired compositions (col. 1, lines 18-35 and col. 2, line 31 – col. 4, line 68).
>
> It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the bulk metallic glass material produced in the process of Fan et al. into a sputtering target by sintering the bulk metallic glass material in powder form as disclosed by Nate et al. ('095) in order to deposit on a substrate a thin film of desired composition and structure as disclosed by Nate et al. ('095) (col. 1, lines 25-28)."

Applicants respectfully disagree with these statements and respectfully request reconsideration. Applicants respectfully submit that the actual teachings of Nate et al. to one of ordinary skill in the art have been misinterpreted and greatly over stated.

Turning first to the present invention, a metallic glass sputtering target is produced by sintering amorphous alloy powder which thereby produces a unique structure for a metallic glass sputtering target that is neither shown nor is made obvious to one of ordinary skill in the art by the cited references. It should be clearly understood that the powder grains are the constituent unit that forms the sintered target structure of the present invention (i.e., sintered body sputtering target made of sintered gas atomized powder of bulk amorphous metallic glass, see claims 2 and 37 of the present application). By way of example, the powder grains of the sputtering target according to the present invention are clearly shown and can be readily observed in FIG. 1 of the present application, as filed. For convenience, FIG. 1 is reproduced below.

Fig 1



In contrast, the amorphous alloy described in Fan et al. is produced as a casting that is manufactured by molten metal of an alloy being poured in fluent molten form into a copper casting mold. Accordingly, it is clear that "powder grains" (i.e., gas atomized powder of bulk

amorphous metallic glass) are not and cannot exist within the structure of the cast samples disclosed by the Fan et al. publication. Thus, it is an error to state that the unique physical features and characteristics of the target of the present invention stated in the claims of the present application can be "expected" to be possessed by the casting taught by the Fan et al. publication.

The Fan et al. publication is a report describing findings upon examining the mechanical properties of alloys based on a compression test and observing plastic strain, ductility and like properties. Fan et al. clearly do not teach, suggest or disclose a method of producing a sputtering target based on the sintering method of the present invention nor does Fan et al. teach or enable the physical properties that are produced thereby.

It should be clearly understood that the "nanocrystals" existing within the structure of the samples of Fan et al. are generated pursuant to the "plastic strain" caused by the hardening and annealing treatment of the samples. Unless the "nanocrystals" are uniformly generated across the entire target (100mm or more in diameter as required of the sputtering target of the claims of the present application), the material cannot form a commercially viable sputtering target product. With respect to this requirement, Applicants refer to FIG. 3 of Fan et al. which clearly describes that the samples of Fan et al. contain "plastic strain" subject to a slip band and a shear band. These are defects which would render the material commercially useless as a sputtering target. (Further, the samples of Fan et al. would not provide the "uniform structure" required by the claims of the present application.) If such defects exist in a sputtering target, the defects will cause abnormal discharge and generate unwanted particles and nodules during a sputtering operation which form unacceptable, faulty and non-usable thin films. It should be clear that the claimed sputtering target is free of such "nanocrystals" and "plastic strain" (i.e., the claims of the

present application require "an ultrafine and uniform structure with an average crystallite size of 1nm to 5nm, said average crystallite size of 1nm to 5nm being uniform entirely throughout said sputtering target, and said target structure being of an amorphous state in which a grain boundary is not observable and being without any crystal growth").

Thus, Fan et al. makes nothing obvious to one of ordinary skill in the art relative to the structure of a metallic glass sputtering target.

Turning to Nate et al., it discloses a specific target made of a specific material. The desired target resists cracking, can be used to form a thin film with a uniform composition and with minimal variation in composition of the target and film, enable high usage efficiency of the target, and provide minimal temporal change of the film composition. Nate et al. teach that sputtering can be used to form a "thin film" of an amorphous alloy specifically made of rare earth elements and transition metals. However, it should be clearly understood that Nate et al. do not teach that it is possible to manufacture amorphous "targets".

Nate et al. disclose a sputtering target of a specific composition made by sintering powders. However, the structure of the "target" of Nate et al. is not amorphous. Rather, the structure of the "target" of Nate et al. is clearly required to include a mixed structure of a crystal phase. In addition, its composition is required to contain rare earth elements (10 to 50at%) as an essential component. Accordingly, both the structure and composition of the target taught by Nate et al. to one of ordinary skill in the art are completely different to that of the present invention as recited in the pending claims of the present application. Still further, Examples 1 to 3 of Table 1 of Nate et al. require the mixed crystal phase to be 30 to 100μm (see column 9 under the heading "Result of Microscopic inspection"/"Fine Mixed Phase"/"size (μm)"), which

is extremely larger than the crystallite size and scale required of the powder grains within the target required by the claims of the present application.

Applicants respectfully submit that the Examiner has misinterpreted the subject matter disclosed by the Nate et al. patent. The Examiner reasons that Nate et al. disclose that "amorphous materials can be formed into sputtering targets by sintering powders" and that the teaching can be applied to any composition with no limitation and with no enabling disclosure required. Applicants respectfully submit that this is incorrect and an overstatement of the teachings of Nate et al. to one of ordinary skill in the art. Nate et al. may teach that a specific material may be formed into a sputtering target by sintering powders and that this sputtering target can be used to form amorphous thin films; however, Nate et al. clearly fail to disclose the structure of the sputtering target being amorphous. In fact, Nate et al. disclose the opposite. The target of Nate et al. is required to include a mixed crystal phase having an average grain size of 30-100μm as discussed above and as clearly disclosed in the Nate et al. patent.

By way of example, column 1, lines 18-35, of Nate et al. (specifically cited in the Office Action) discloses that thin films of amorphous alloys comprising a rare earth element and a transition metal such as Tb-Fe-Co or Gd-Tb-Fe are usable as magneto-optical recording media. Column 1, lines 25-28, of Nate et al. specifically teaches that "as a method of manufacturing a thin film of such amorphous alloy, a sputtering method ... is often used". Thus, while the thin film is required to be an amorphous alloy thin film, there is no teaching or suggestion provided by Nate et al. that the structure of the sputtering target itself is amorphous.

Further, column 1, lines 29-35, of Nate et al. discloses an example of a prior art target which has "a mixed structure comprising a phase of intermetallic compound of rare earth

element and transition metal and a phase of transition metal alone" and which is clearly not amorphous.

Column 2, line 31, to column 4, line 68, of Nate et al. (specifically cited in the Office Action) discloses a sintered sputtering target having the above discussed mixed crystal phase having an average grain size of 30-100μm. Again, while the thin film produced by the sputtering target may be amorphous, the sintered body sputtering target of Nate et al. is not. During a sputtering operation, the composition of the thin film is necessarily the same as the target; however, the microstructure is not necessarily the same between the target and thin film.

For this reason, Applicants submit that the rejection of the claims of the present application as obvious over Fan et al. in view of Nate et al. is in error and should be reconsidered and withdrawn for the reasons discussed above. Applicants respectfully submit that the combination of prior art references does not teach the target structure required by the claims of the present application. Fan et al. fail to disclose a sputtering target or a sintered structure formed of powder grains, and Nate et al. disclose a sintered sputtering target having a mixed crystal phase of an average grain size of 30-100μm. One of ordinary skill in the art relying on common sense and producing a sintered body sputtering target based on this combination would produce a target body having a mixed crystal phase of an average grain size of 30-100μm as clearly directed by the teachings of the Nate el al. patent which is the only reference that discloses a sputtering target.

Further, Fan et al. is an academic document which reports its findings concerning mechanical properties of alloys; while, Nate et al. is directed to an alloy sputtering target for producing magneto optical recording media. The technical fields of these references are clearly different, and Applicants respectfully submit that there is no common sense motivation to lead

one of ordinary skill in the art to combine the unrelated teachings of these references. Further the object and usage of the teachings of Fan et al. and Nate et al. are entirely different from that of the present invention, and the present invention as claimed in the present application could not have been conceived or considered obvious based on the combination of these references.

As yet an additional reason for why one of ordinary skill in the art would not combine the teachings of Fan et al. and Nate et al., Nate et al. provide teachings that teach-away from the material discussed in the Fan et al. publication. As best stated in column 2, lines 35-60, of Nate et al., the composition of Nate et al. clearly requires 10 to 50at% of a rare earth metal, 0.1 to 10at% of an additive element (which includes Zr), and the balance consisting of one or more transition metals. With respect to the additive (Zr), Nate et al. teach to one of ordinary skill in the art that "the magneto-optical property of the thin film is not satisfactory if it exceeds 10 atom %."

Accordingly, one of ordinary skill in the art is clearly directed by Nate et al. to limit Zr content to 10at% or less. This is in direct conflict with the teachings of Fan et al. which require a much greater Zr content. Thus, one of ordinary skill in the art would clearly find these teachings to be in conflict with one another and would clearly not view the teachings of Nate et al. to be relevant to the teachings of the Fan et al. publication.

In the Office Action, the teachings of Nate et al. are interpreted as being applicable to all and any "desired" composition with there being no limit to the composition and with there being no requirement of enablement. Applicants respectfully submit that one of ordinary skill in the art would consider the teachings of Nate et al. in its entirety and would not simply determine that Nate et al. provides some wide-sweeping teaching that can be relied upon for any composition despite the explicit teachings of Nate et al. that using a composition with more than 10at% of Zr

is "not satisfactory" (i.e., Nate et al. clearly teachings not to use more than 10at% of Zr). It is unclear to Applicant why it would be obvious to one of ordinary skill in the art to simply ignore this explicit statement of Nate et al. and to expand the scope of the teaching of Nate et al. to apply to all compositions without any requirement of an enabling teaching of such wide breadth and infinite and indefinite scope.

Accordingly, Applicants respectfully submit that it would not be obvious under the requirements of 35 USC §103(a) for one of ordinary skill in the art to combine the teachings of Nate et al. with the teachings of Fan et al. based on the contrary teachings with respect to Zr content.

For all the reasons discussed above, Applicants respectfully submit that independent claims 2 and 37 of the present application are not obvious over Fan et al. in view of the Nate et al. patent. Applicants respectfully request reconsideration and removal of the rejection.

B. In the non-final Office Action dated January 20, 2011, claims 39-41 are rejected under 35 USC §103(a) as being obvious over the publication of Fan et al. titled "Deformation behavior of Zr-based bulk nanocrystalline amorphous alloys" in view of U.S. Patent No. 4,992,095 issued to Nate et al. and further view of the publication of Kakiuchi et al. titled "Application of Zr-Based Bulk Glassy Alloys to Golf Clubs".

Applicants respectfully submit that dependent claims 39-41 are patentable over Fan et al. in view of Nate et al. and further in view of Kakiuchi et al. for the same reasons discussed above that independent claim 37 is patentable over Fan et al. in view of the Nate et al. patent.

Accordingly, Applicants respectfully request reconsideration and removal of the rejection of claims 39-41.

Conclusion

In view of the above arguments, Applicants respectfully submit that the rejections have been overcome and that the present application is in condition for allowance. Thus, a favorable action on the merits is therefore requested.

Please charge any deficiency or credit any overpayment for entering this Response to our deposit account no. 08-3040.

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